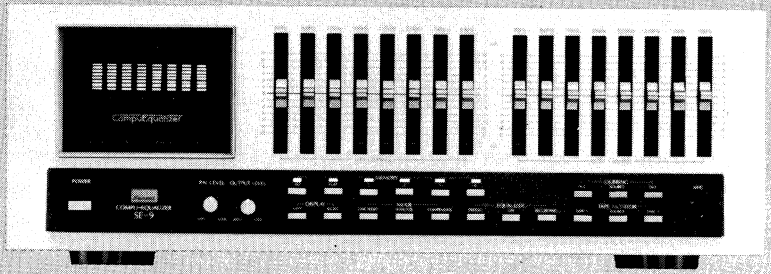
SERVICE MANUAL

COMPU-EQUALIZER

SANSUI SE-9



Sansui

SANSUI ELECTRIC CO., LTD.

• SPECIFICATIONS

Input impedance (1,000Hz)
- INPUT . . . . . 30 kilohms
- MIC . . . . . 47 kilohms

Output level (1,000Hz)
- OUTPUT . . . . . .1V into 47 kilohms
  (Maximum output level: 5V at 0.5% total harmonic distortion)

Total harmonic distortion (20Hz to 20kHz)
- INPUT . . . . . less than 0.008%

Frequency response (at rated output, Equalizer controls: "0" position) . . . . . 10 to 100,000Hz, +0dB, −1dB

Equalizer frequency . . 80Hz, 160Hz, 315Hz, 630Hz, 1.25kHz, 2.5kHz, 5kHz, 10kHz

Level variation range . . ±12dB

Signal to noise ratio (short-circuit, A-network) 110dB

Gain (1,000Hz, Equalizer controls: "0" position) 0dB

Power requirements
- Power voltage 100, 120, 220, 240V (50/60Hz)
  For USA and Canada 120V (60Hz)
- Power consumption . . . . . 30 watts

Dimensions . . . . . 430mm (16-15/16") W, 148mm (5-7/8") H, 311mm (12-1/4") D
- Using rack mounting adaptors . . . . . 480mm (18-15/16") W, 148mm (5-7/8") H, 330mm (13") D

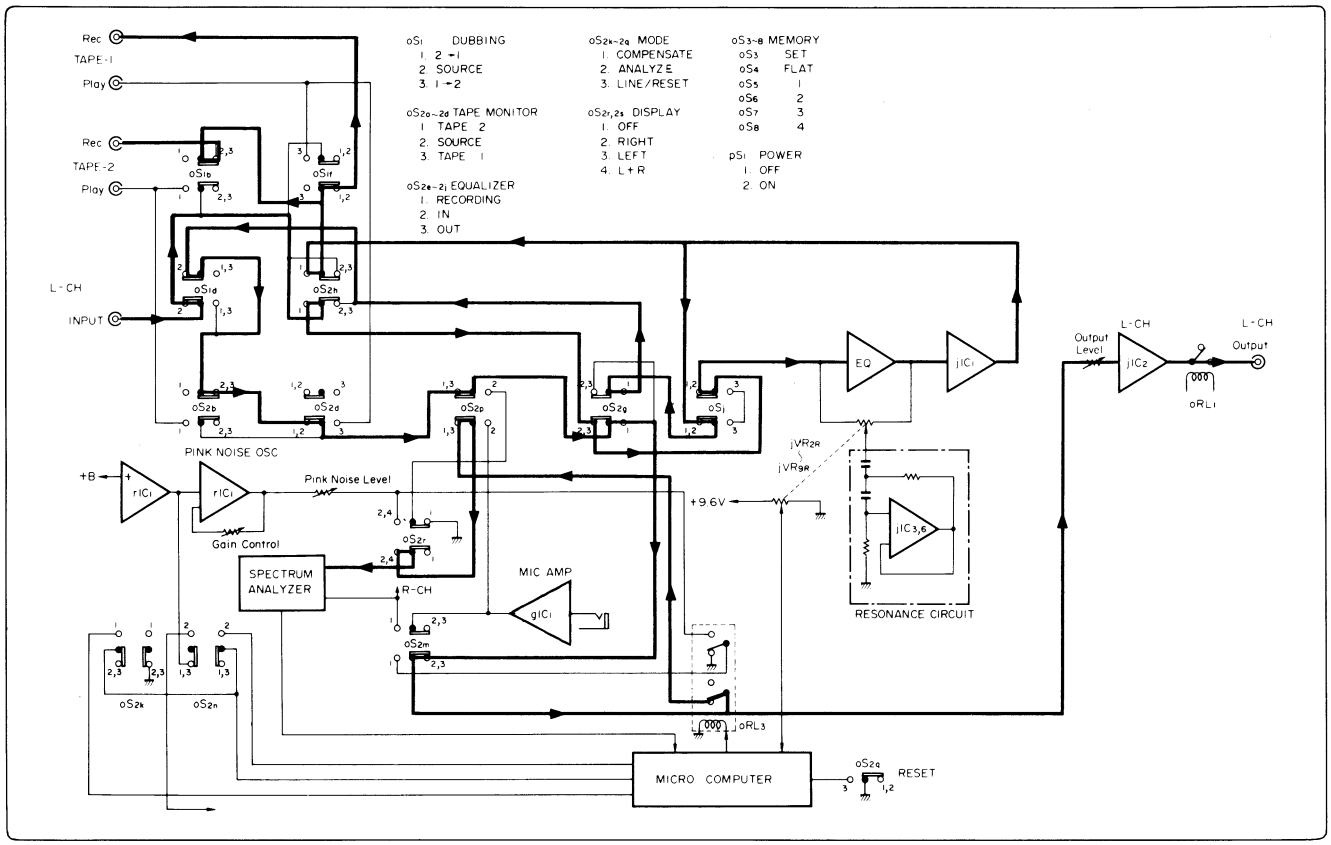
Weight
- Silver panel type . . 6.6kg (14.6lbs) net, 7.9kg (17.4lbs) packed
- Black panel type . . 6.8kg (15.0lbs) net, 8.1kg (17.9lbs) packed

* Design and specifications subject to changes without notice for improvements.

1. BLOCK DIAGRAM

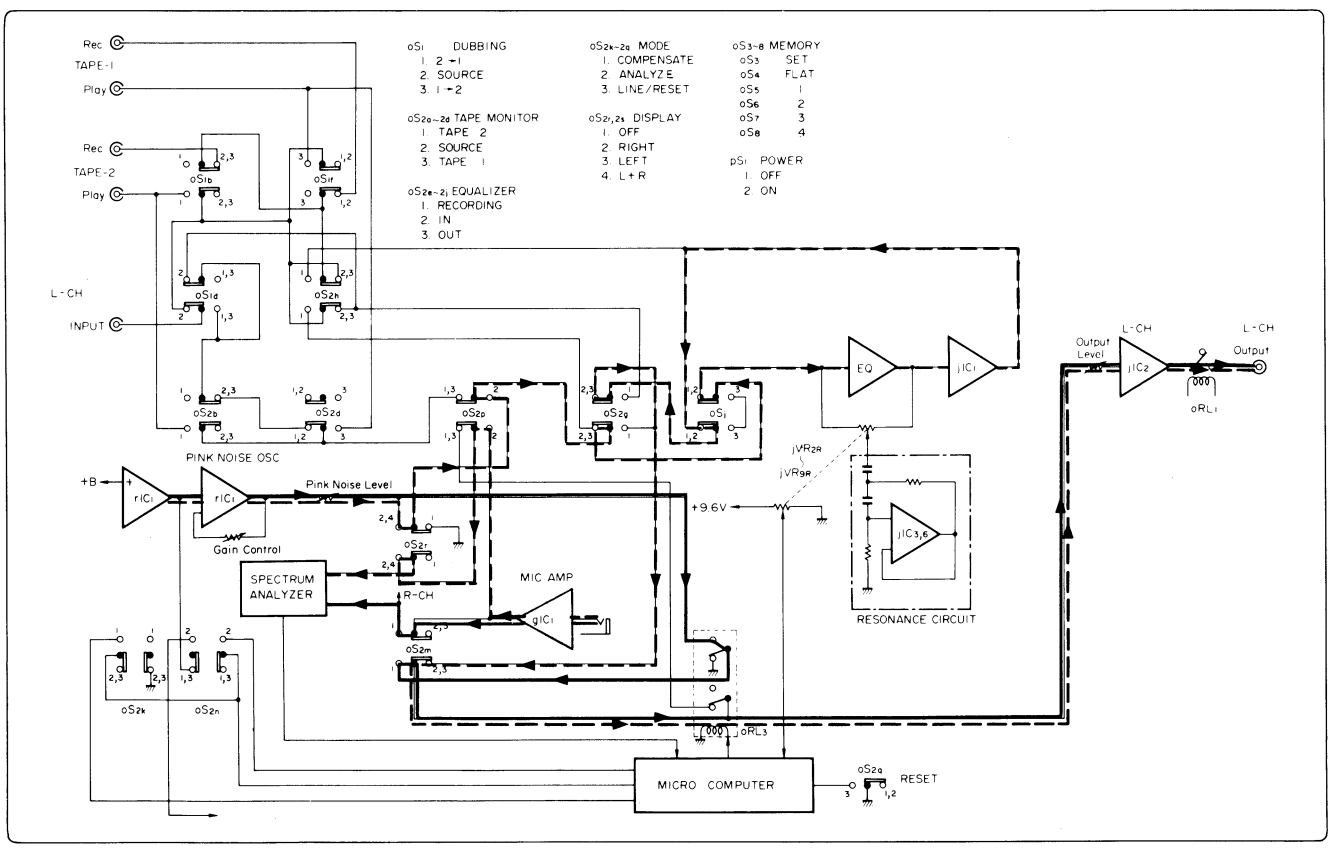
1-1. Audio Signal Line

Switches
(DUBBING . . . . . > SOURCE
EQUALIZER . . . . . > RECORDING
TAPE MONITOR . . . > SOURCE
MODE . . . . . > LINE/RESET)

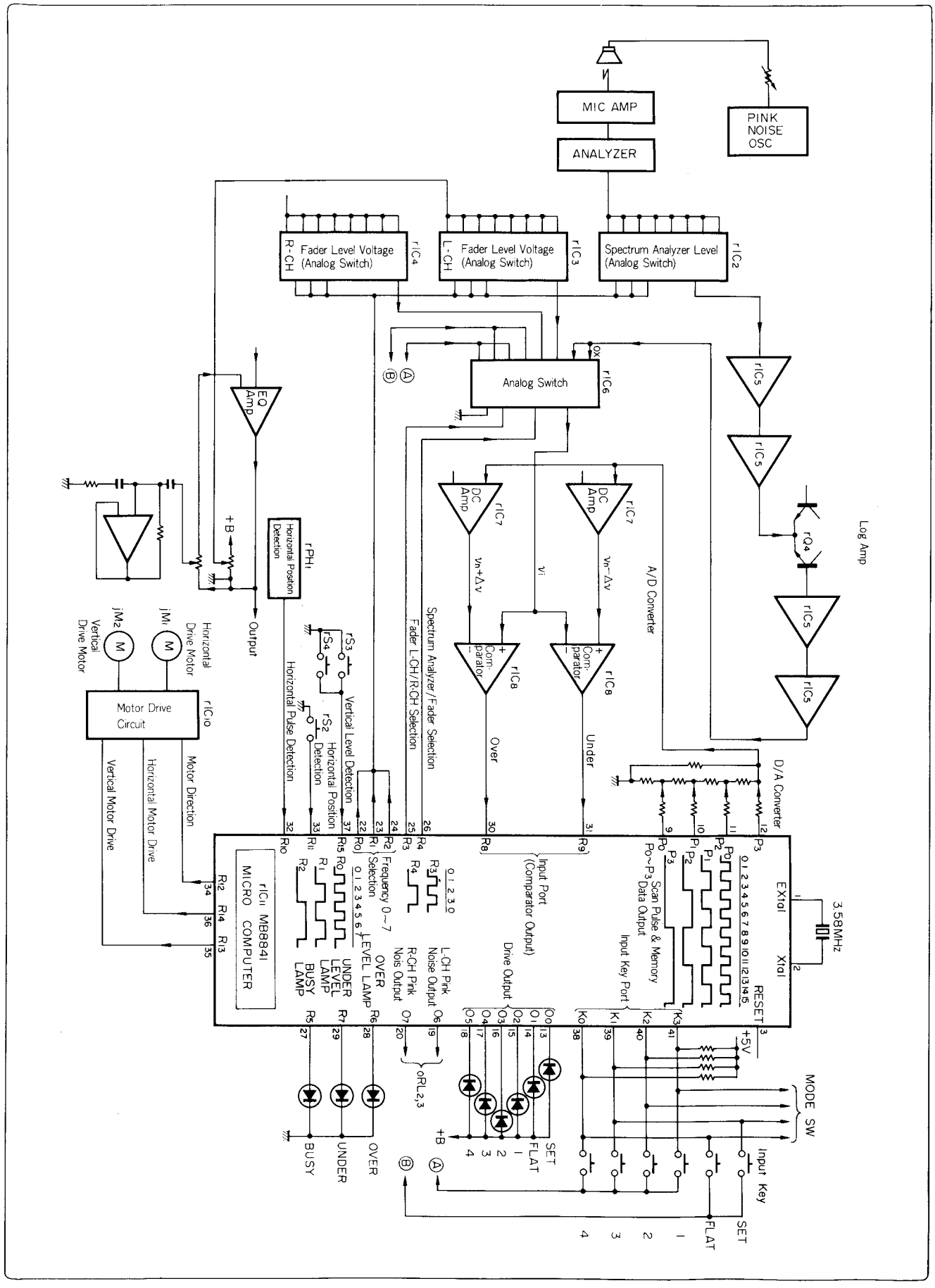


1-2. Compensate & Analyzer Mode

Switches
(———COMPENSATE ----ANALYZE)



1-3. Micro Processor Section



2. FUNCTION & OPERATION

2-1. Functions and Circuit Configuration

The SE-9 is a graphic equalizer provided with a microcomputer and a spectrum analyzer, the feature of which is to make it possible to keep the frequency characteristics of the play back system under an ideal condition automatically through the processing of the micro-computer.

A. Main functions

1) Eight-band, left-and-right independently adjustable graphic equalizer
2) Eight-band spectrum analyzer provided with the characteristics corresponding to the graphic equalizer bands and its Q (selectivity)
3) Sound-field measurement function to indicate overall frequency characteristics of the room acoustics and the equipment acoustics
4) Sound-field transfer characteristics leveling (compensation) function
5) Memory function to store preferable sound
6) Reproduce function of Sansui's message sound menu
7) Self-testing function against troubles

B. Circuit configuration

1. Audio section

Graphic equalizer with a range of ±12dB, by which eight-bands (80Hz ~ 10kHz) are adjustable on both the left and right sides, independently.

Being the same as in SE-5/7/8, the circuit is configured based on a combination of resonance circuits (band-pass filters) made up of semiconductor inductors which use low noise ICs.

1) Eight-band spectrum analyzer, which is basically the same as the circuits used with the B-55/77, and SE-8.
2) Pink noise generator necessary to measure sound-field characteristics.
3) Microphone amplifier to make flat characteristics while picking up pink noise by the use of an external microphone.
4) Tape circuits to make it possible to perform monitor, mutual dubbing, equalizer recording by the use of two tape decks.

2. Micro-processor section (See the block diagram on page 2.)

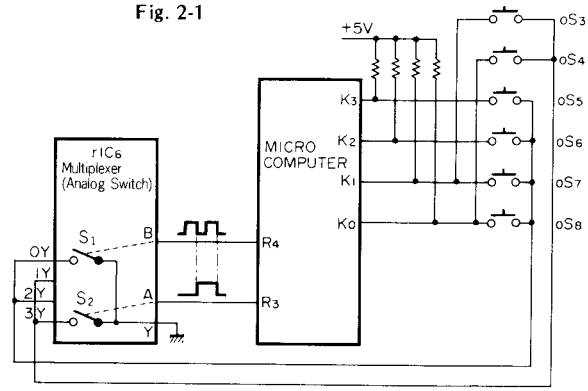
1) A microcomputer (MB8841) including a 128 x 4bit RAM is used. The supply voltage of this microcomputer is +5V, therefore, the output at RESET is "1" level (High : +5V).
2) Soft scanning type input switch circuit.
3) Analog-to-digital converter made up of a D-A converters, DC amplifiers, comparaters, and a CPU.
4) Analog switch circuit made up of three eight-channel CMOS multiplexers (rIC_2, $_3$, $_4$) and one four-channel x 2 CMOS multiflexer (rIC_6), through which the voltage outputted from a spectrum analyzer and the fader voltage are selected.
5) Logarithmic amplifier
6) Motor drive circuit for fader drive
7) Mechanism position detection circuit for fader drive
8) Indicator circuit

2-2. Operations of Main Circuits

A. Operation of key input circuit

A method of soft scanning is used to discriminate the key inputs. Scanning is performed by shorting it to the ground or by opening it from the ground, that is, the respective one side terminals of the key switches are connected to the input ports of the microcomputer and pull-up resistors, and the respective other terminals of the key switches are connected to the ground through analog switches. Fig. 2-1 shows a block diagram of the key input circuit.

Fig. 2-1



Note: Soft scanning: A scanning pulse is generated within the microcomputer to discriminate the key inputs.

When a scanning pulse from the output port R_4 on the CPU turns on the analog switch S_1 of the multiplexer, the common terminals of the input keys $S_{5\text{-}8}$ are connected to the ground. Therefore, it is possible to check whether the input keys $S_{5\text{-}8}$ are depressed or not by checking whether each input port is "1" (high) or "0" (low). This is the same as in the analog switch S_2.

Fig. 2-2, 2-4 show a function diagram of the multiplexer (analog switch MB84052B, MB84051B) and Fig. 2-3, 2-5 show its function table.

Fig. 2-2

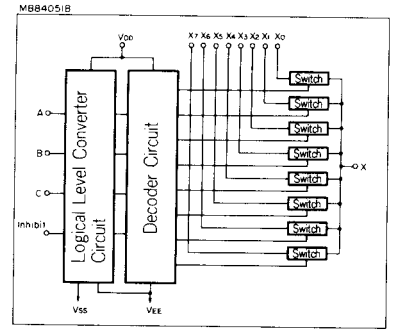


Fig. 2-3

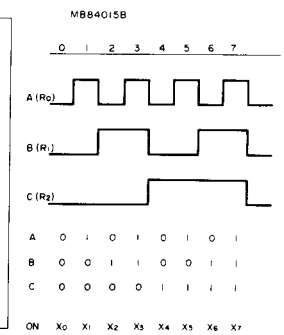


Fig. 2-4

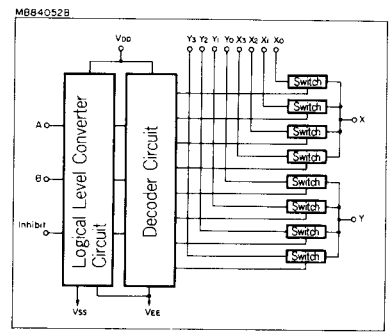
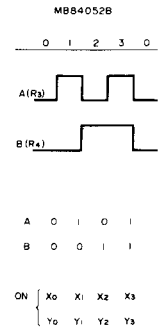


Fig. 2-5



Next, a method of discriminating the key switch inputs will be explained below.

1) When "00" is outputted from the ports R_3 and R_4 on the microcomputer, the discrimination is as follows:

K_3	K_2	K_1	K_0	(Input ports)
1	1	1	1	No key input
1	1	1	0	Memory switch 4 is on.
1	1	0	1	Memory switch 3 is on.
1	0	1	1	Memory switch 2 is on.
0	1	1	1	Memory switch 1 is on.

2) When "01" is outputted from the ports R_3 and R_4 on the microcomputer, the discrimination is as follows:

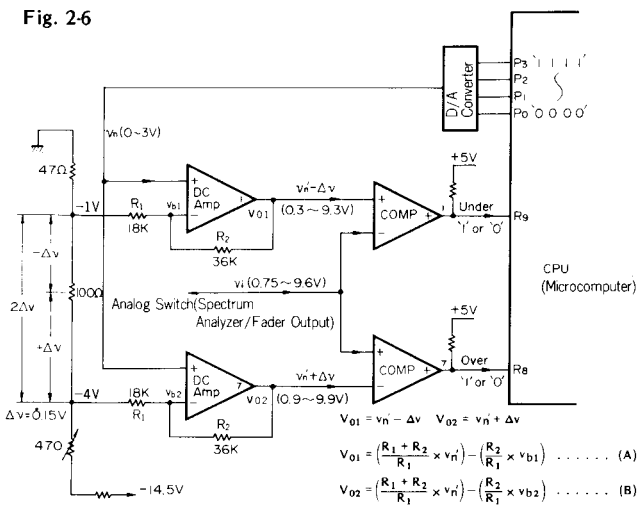
K_3	K_2	K_1	K_0	(Input ports)
1	1	1	1	No key input
1	1	1	0	FLAT
1	1	0	1	SET
1	0	1	1	COMPENSATE (LEVELING)
0	1	1	1	ANALYZE (MEASUREMENT)

As described above, the memory switches and mode switches can be selected by combining the inputs of the input ports K_3-K_0. Further, although no COMPENSATE switch and no ANALYZE switch are included in the input switches of Fig. 2-1, these switches are connected to the input ports K_2 and K_3, and switched to "0" or "1" in the same manner as in the switches S_3 and S_4.

B. Analog-to-digital converter

The A-D converter is made up of a D-A converter, DC amplifiers, comparators and a CPU. (See Fig. 2-6.)

Fig. 2-6



1. Operations when sound field is stored into the CPU

When a digital data of binary code from "0 0 0 0" to "1 1 1 1" is outputted from the output ports P_0~P_3 on the CPU, the digital data is converted into a DC voltage corresponding to the digital data through the D-A converter, next amplified into an appropriate voltage level through the DC amplifier, and then inputted into the two comparators.

Now, when the output ports P_0 ~ P_3 are Varied from "0 0 0 0" to "1 1 1 1" with the DC voltage v_i from the spectrum analyzer set at 4.8V and with the voltage Δv set at 0.15V, the voltage v_n ranges approximately from 0.6 to 9.9V. When the voltage v_n approches to v_i under the above-mentioned conditions, the outputs of the two comparators are as follows:

v_i	$v_n' + \Delta v$	OVER OUTPUT	$v_n' - \Delta v$	UNDER OUTPUT
4.8V	5.55V	$> v_i \longrightarrow 0$	5.25V	$> v_i \longrightarrow 1$
4.8	4.95	$> v_i \longrightarrow 0$	4.65	$< v_i \longrightarrow 0$
4.8	4.35	$< v_i \longrightarrow 1$	4.05	$< v_i \longrightarrow 0$

The above table indicates that when v_n is 4.8V, the OVER and UNDER outputs are both zero. The above relationship can be expressed as follows:

$$v_n' + \Delta v \geqq v_i \geqq v_n' - \Delta v \quad \ldots\ldots\ldots\ldots \quad (1)$$

When the above expression is satisfied, the digital data at the output ports P_0 to P_3 are stored as the output data from the spectrum analyzer. In the manner described above, frequencies from 80Hz of L-ch (left channel) to 10kHz of R-ch (right channel) are stored in order as the data.

When desired characteristics (desired fader position) are required to store by depressing the SET switch and one of the MEMORY switches 1-4, the above description is true except that the fader voltage is applied to the comparators as the voltage v_i in place of the voltage from the spectrum analyzer.

2. Sound reproduction of data stored in CPU

There are explained below A-D converter operations to control the fader when compensate characteristics, desirable-arranged characteristics, desirable-arranged characteristics, and Sansui's message are reproduced.

The fader is controlled 16 times in order from the lowest band (80Hz) of L-ch to the highest band (10kHz) of R-ch. First, a digital data representative of fader position required to shift is fetched from the RAM, and next inputted to one input terminal of the comparator. A level voltage of the fader is applied to the other input terminal of the comparator. Since the voltage v_i is compared with $v_n' + \Delta v$ and with $v_n' - \Delta v$ through the comparators, the CPU determines so that when "1" is outputted from the UNDER output, the fader can be shifted upward and when "1" is outputted from the OVER output, the fader can be shifted downward.

In accordance with the change at the input ports R_8 and R_9, the CPU controls the motor so as to shift the fader and stops the motor at the position where the expression (1) under Paragraph 2-2: $v_n' + \Delta v \geqq v_i \geqq v_n' - \Delta v$ is satisfied, so that the fader shift stops. In this case, it is possible to express the voltage v_n' as follows:

v_0 . . . Output port "0 0 0 0" output voltage (n = 0)
v_1 . . . Output port "0 0 0 1" output voltage (n = 1)
v_{15} . . . Output port "1 1 1 1" output voltage (n = 15)

In other words, the voltage v_n changes into 16-step voltages according to the value of n ($0 \leqq n \leqq 15$).

However, the maximum voltage is v_n' max $2^4 \times 2 \times \Delta v$ because the difference in reference voltage between the two comparators is 2 Δv.

Therefore, $\Delta v = \dfrac{v_n' \text{ max}}{32}$

The fader can be divided into 32 steps, so that it is possible to control the fader further accurately.

Fig. 2-7

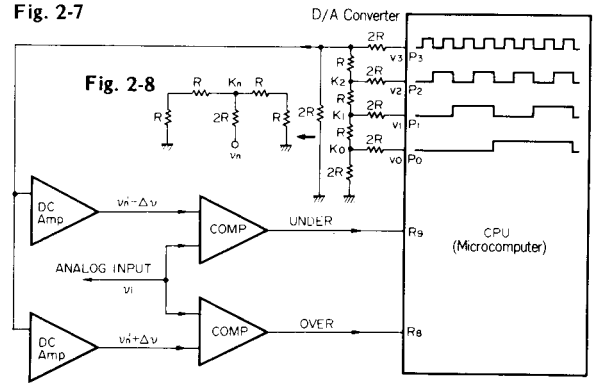


Fig. 2-8

3. Operations of D-A converters

Fig. 2-7 shows the grid-type D-A converter.

When seen from each point K_0, K_1, K_2, or K_3, the D-A converter can equivalently be shown as in Fig. 2-8.

That is say, $v_{kn} = \dfrac{1}{3} v_n'$

This voltage becomes smaller half by half in proportion as it approaches to the output terminal. Therefore, the point of v_{k1} becomes $1/2^3 \cdot Vk$.

Here, if $v_4 = v_3 = v_2 = v_1 = Es$ and the state of each bit is b_4, b_3, b_2, or b_1, v_0 can be expressed as follows:

$$v_0 = \frac{1}{3} Es \left(b_4 + \frac{1}{2} b_3 + \frac{1}{4} b_2 + \frac{1}{8} b_1\right)$$

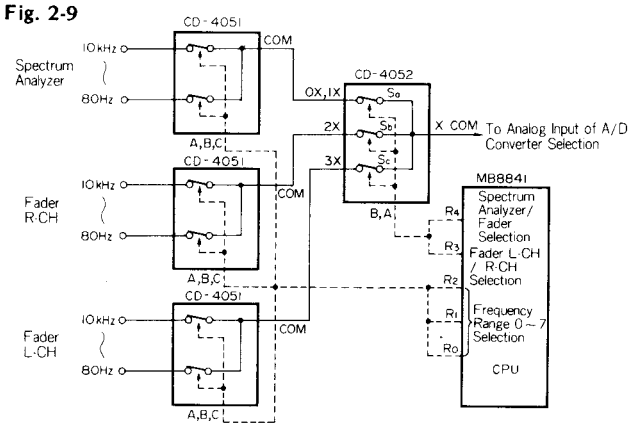
C. Operations of multiplexer

(Analog switch for spectrum analyzer voltage and fader level voltage)

The DC-like spectrum analyzer voltage and fader level voltage are

connected to the analog input of Fig. 2-6 and converted into digital data as explained already under Paragraph B.
First, the spectrum analyzer or L-ch/R-ch fader DC voltage are connected to the input of input of the A/D converter by the use of the analog switches Sa, Sb, and Sc of MB84052 as shown in Fig. 2-9. When the output ports R_4 and R_3 are so controlled that the Sa is closed, DC-like spectrum analyzer output voltage of 80Hz-10kHz is connected to the A/D converter. Also, by controlling the output ports R_0, R_1 and R_2, it is possible to select one of eight bands. Similarly, it is possible to measure the fader level voltage of L-ch/R-ch.
The spectrum analyzer voltage or fader level voltage connected to the analog input of the A-D converter is converted into digital data and next stored into the RAM of the CPU, as explained under Paragraph B.

Fig. 2-9



D. Operations of logarithmic amplifier

The fader level information stored into the RAM of the microcomputer and the motor drive to shift the fader are changed according to a logarithmic characteristic of ±12dB per band. Therefore, since it is necessary to change the spectrum analyzer voltage applied to the comparator input according to a logarithmic characteristic, the logarithmic amplifier is connected between the analog switches rIC_2 and rIC_6 as shown in the block diagram.

* Operations of logarithmic amplifier

Fig. 2-10

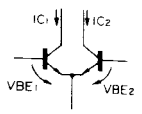
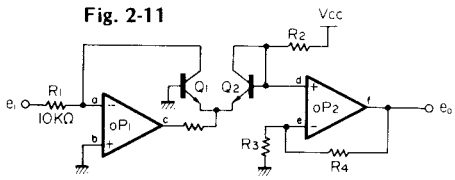


Fig. 2-11



With reference to Fig. 2-10, the difference of ΔV_{BE} ($\Delta V_{BE1} - \Delta V_{BE2}$) in base-emitter voltage between two transistors can be expressed as follows:

$$\Delta V_{BE} = \frac{kT}{q} \ln \left(\frac{IC_1}{IC_2}\right) \quad \cdots\cdots (2)$$

Where IC_1, IC_2 : collector currents
k : Boltzmann's constant
T : absolute temperature
q : electron charge
ln : natural logarithm

When a logarithmic amplifier as shown in Fig. 2-11 is configured on the basis of Expression (2), the collector current of the transistor Q_1 is almost equal to the input current applied to the terminal a, therefore

$$IC_1 = \frac{e_i}{R_1} \quad \cdots\cdots (3)$$

On the other hand, the collector current of the transistor Q_2 is determined by V_{CC} and R_2 as follows:

$$IC_2 = \frac{V_{CC}}{R_2} \quad \cdots\cdots (4)$$

From expressions (2), (3) and (4), the following expression can be obtained;

$$\Delta V_{BE} = \frac{kT}{q} \ln \left(\frac{R_2}{R_1} \cdot \frac{e_i}{V_{CC}}\right) \quad \cdots\cdots (5)$$

Since the base of the transistor Q_1 is grounded, the input applied to the next stage (terminal d) is reversed in polarity. Since the gain of the operational amplifier OP_2 is expressed as

$$Av = \frac{R_3 + R_4}{R_3} \quad \cdots\cdots (6)$$

the output voltage e_0 can be expressed as follows:

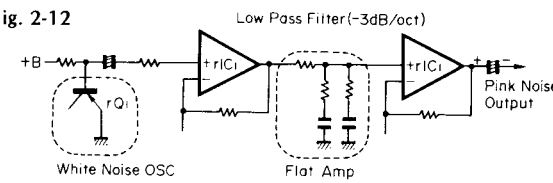
$$e_0 = Av \times (-\Delta V_{BE}) = \frac{kT}{q} \cdot \frac{(R_3 + R_4)}{R_3} \cdot \ln \left(\frac{R_2}{R_1} \cdot \frac{e_j}{V_{CC}}\right) \quad \cdots\cdots (7)$$

That is, it is indicated that the output voltage e_0 is proportional to the logarithmic value of the input voltage e_i.
The gradient of the logarithmic characteristic can be determined by the resistor R_3 and R_4, and the input voltage when the output voltage is zero can be determined by the resistors R_1 and R_2.

E. Operations of pink noise generator

In order to automatically obtain a flat transfer characteristic depending upon measured sound characteristics, pink noise is generated by a pink noise generator. In the pink noise generator, as shown in Fig. 2-12, the transistor rQ_1 is used in the zener region to generate white noise, and next the white noise is amplified through a low-pass filter of −3dB to generate pink noise.
The reason why white noise cannot be used in measuring sound field is that since white noise energy per frequency is constant, the white noise energy increases by +3dB per octave. Therefore, it is necessary to pass white noise through a low-pass filter of −3dB/oct to generate pink noise.

Fig. 2-12



2-3. Unit Control Program of Microcomputer

A. Measurement of sound field

1. **Determination as to whether all eight-band outputs lie within a specified range or not.**
   1) Output ports to be used : $(P_0 \sim P_3)$ $(R_0 \sim R_2)$ (R_3, R_4)
   2) Input ports to be used : (R_8, R_9)
      Sequence (order of operations)
      a) The output of the spectrum analyzer is connected to the comparator inputs.
         The data of "0 1" is outputted from the output ports R_3 and R_4.
      b) Scanning pulse to switch the band of spectrum analyzer are outputted from the output ports R_0, R_1 and R_2.

R_2	R_1	R_0	(Output ports)	
0	0	0	80Hz	(Lowest frequency)
0	0	1	160Hz	
0	1	0	315Hz	
0	1	1	630Hz	
1	0	0	1.25kHz	
1	0	1	2.5kHz	
1	1	0	5kHz	
1	1	1	10kHz	(Highest frequency)

      c) The maximum and minimum data of D-A converter are outputted from the output ports $P_0 \sim P_3$, and the comparator outputs of OVER and UNDER are checked at the input ports R_8 and R_9 for determination.

2. **Alarm indication when the level is not correct.**
 1) Output ports to be used : R_6, R_7
  a) In case of over-level, "1" is outputted from the output port R_6 to flash the LED.
  b) In case of under-level, "1" is outputted from the output port R_7 to flash the LED.

B. Operation of compensation

1. **Measurement of sound field**
 1) Output port to be used : $(P_0 \sim P_3)$ $(R_0 \sim R_4)$ (O_6, O_7)
 2) Input port to be used : (R_8, R_9)
  Sequence
  a) "1" is outputted from the output port O_6 to generate pink noise.
  b) The output of spectrum analyzer is connected to the comparator inputs.
  c) While changing the D-A output at the output ports $P_0 \sim P_3$, the values of ports $P_0 \sim P_3$ when the input ports R_8 and R_9 become "0" are stored into the RAM as measurement data.
  d) By switching bands at the output ports $R_0 \sim R_2$, above-mentioned all band data in L-ch can be fetched.
  e) "1" is outputted from the output port O_7 to generate pink noise.
  f) R-ch is measured in the same procedure as explained under items b, c, and d.

2. **Operation of compensation and reproduction of Sansui's message**
 1) Output port to be used : $(P_0 \sim P_3)$ $(R_0 \sim R_4)$ $(R_{12} \sim R_{14})$
 2) Input port to be used : (R_8, R_9) (R_{10}, R_{11}, R_{15})
  Sequence
  a) The fader position data output of L-ch lowest frequency band is connected to the comparator inputs.
  "1 0" is outputted from the output ports R_3 and R_4.
  "0 0 0" is outputted from the output ports R_0, R_1, and R_2.
  b) The memory contents of L-ch are outputted from the output ports $P_0 \sim P_3$.
  c) The direction in which fader is shifted is determined by the input ports R_8 and R_9.
  d) The Y-axis motor is controlled by the output ports R_{12} and R_{13}. (The motor is moved up and down.)
  e) The input port R_{15} detects that the Y-axis mechanism reaches the uppermost or lowermost position, and stops the Y-axis motor. ("0" is outputted from the output port R_{13}.)
  f) The X-axis mechanism is moved rightward when "1" is outputted from the output port R_{14} and is stopped when "1" is detected at the input port R_{10}. The pulse is generated by the combination of 32-piece chassis holes (behind the fader control knob), LEDs and phototransistors.
  g) The Y-axis mechanism is controlled to rotate the fader control knob.
  h) When "0" is outputted from the comparator outputs R_8 and R_9, the Y-axis mechanism stops.
  i) The X-axis mechanism is moved rightward.
  (It takes 0.5 sec to cover one band and about 30 sec to cover the total bands.)
  j) By repeating the above-mentioned sequence, each fader is controlled. The X-axis mechanism is returned to the initial position after every procedures have been completed.

C. Manual-writing of desired characteristics

 1) Output ports to be used : $(R_0 \sim R_2)$ (R_3, R_4) $(P_0 \sim P_3)$
 2) Input ports to be used : (R_8, R_9)
  Sequence
  a) "0 1" is outputted from the output ports R_3 and R_4 and the output of the fader L-ch is inputted to the comparators.
  b) By changing the data of the output ports, the input ports R_8 and R_9 are checked to obtain the data. The data of R-ch can be obtained in the same manner. Since the voltage across the fader control knob does not fluctuate, it is possible to fetch the data readily at one time.

3. SELF-CHECKING FUNCTION & TROUBLE SHOOTING IN MICROPROCESSOR

3-1. Self-checking function

When some trouble occurs in the microprocessor section and therefore the automatic sequence (operation order) stops, the BUSY lamp flashes, about three seconds after the stop of sequence, to indicate trouble. After that, when the test pins TP17 and TP19 on the substrate F-3504 are shorted and the PRESET button is depressed (See the upward picture on page 12), the self-checking function of microcomputer starts, and the memory LEDs 1-4 come on according to the kinds of trouble.

Relationships between trouble contents and lighting LEDs

Memory LED1	: No detection of shift pulse when fader drive mechanism moves on the X-axis.
Memory LED2	: No detection of initial motor drive position
Memory LED3	: No detection of shift pulse when fader drive mechanism moves on the Y-axis.
Memory LED4	: Malfunction of comparators
All LEDs 1-4	: Normal CPU, but some trouble other than described above

3-2. Points of troubleshooting

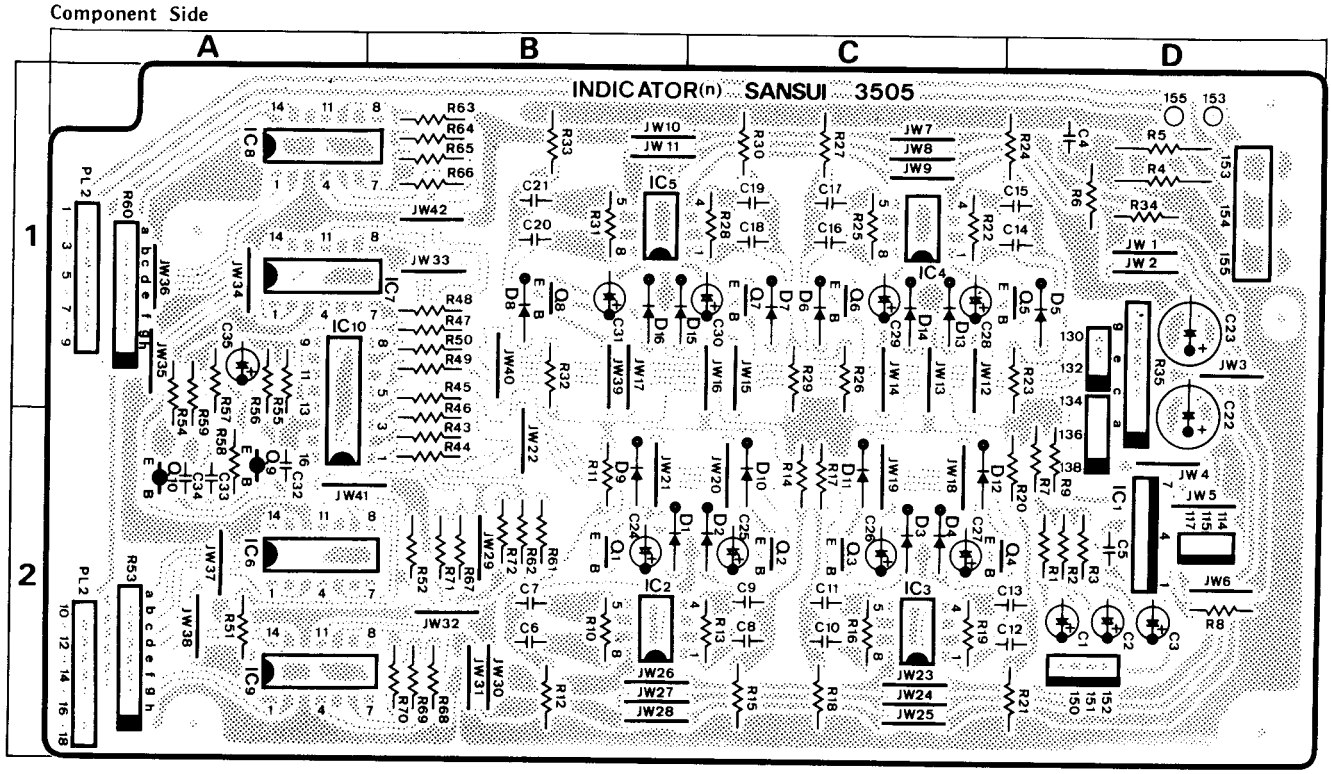
 1) Determine the trouble spot roughly depending upon the self-checking function of the microprocessor. When all the memory LEDs 1-4 come on, the CPU is normal. Then check other spots.
 2) Identify trouble conditions and trouble spots in various modes such as sound field measurement, fader up-and-down control, etc.
 3) Check the microprocessor by dividing it into several blocks. First, check that the audio equipment is normal, and check it in the following order: input key circuit, analog switch circuit, fader drive circuit, A-D Converter circuit, indicator circuit, fader position detection circuit, fader drive mechanism (thread tension, etc.)
 4) There occurs seldom trouble with the microcomputer except when an excessive voltage is applied to the B-circuit or when one of the output ports is grounded. Therefore, first check the peripheral circuits.

4. PARTS LOCATION & PARTS LIST

4-1. F-3505 Spectrum Analyze Circuit Board (Stock No. 00657301)

•Since some of capacitors and resistors are omitted from parts lists in this Service Manual, refer to the Common Parts List for capacitors & resistors, which was appended previously to Sansui Manual.

Component Side



Parts List

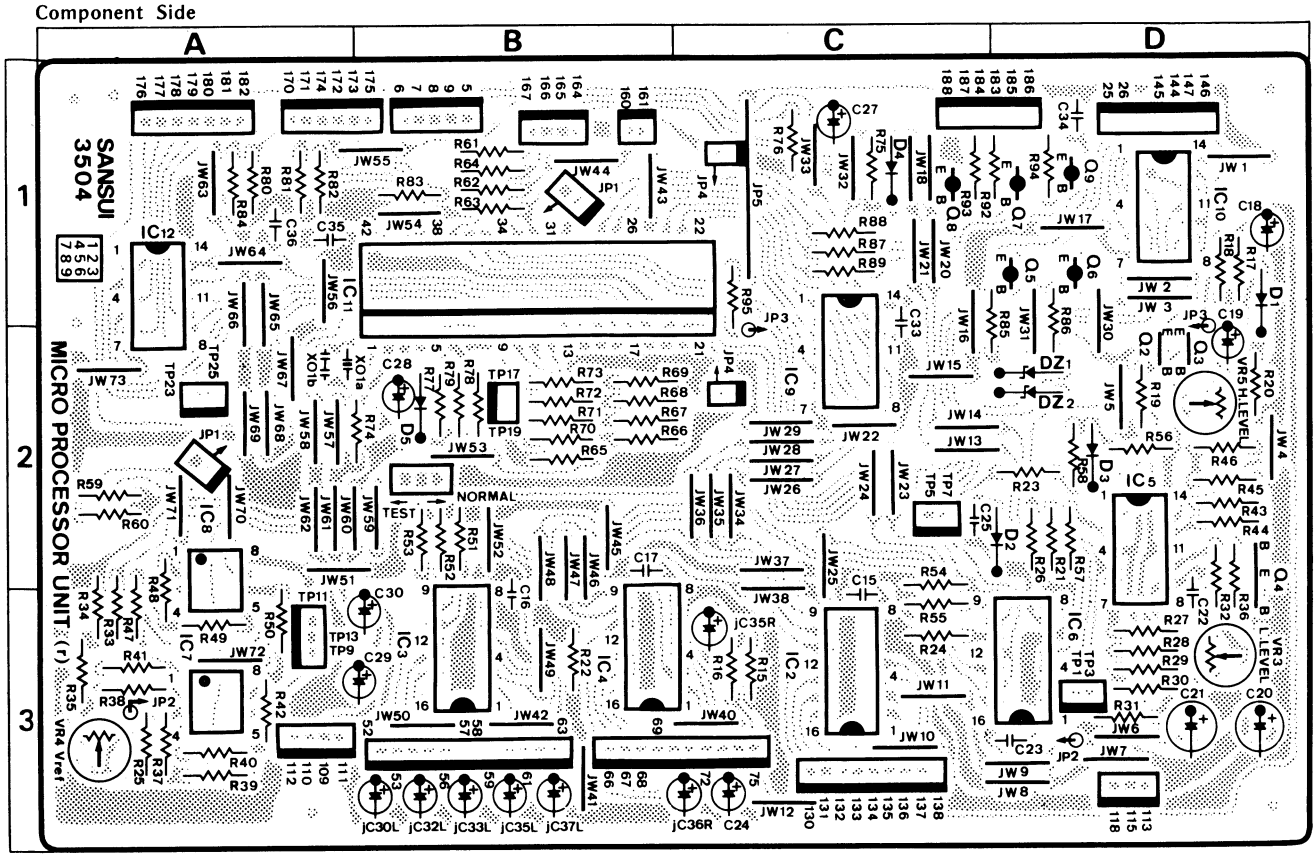
Parts No.	Stock No.	Description
•Transistor		
nQ1	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ2	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ3	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ4	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ5	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ6	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ7	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ8	07194800	2SC1815-Y
	03068301	2SC2320-E
nQ9	07194700	2SA1015-Y
	03012700	2SA999-E
nQ10	07194700	2SA1015-Y
	03012700	2SA999-E
•IC		
nIC2	03607700	NJM4558D
	07265800	MB3607M
nIC3	03607700	NJM4558D
	07265800	MB3607M
nIC4	03607700	NJM4558D
	07265800	MB3607M
nIC5	03607700	NJM4558D
	07265800	MB3607M
nIC6	07205300	NJM2901N
	07246300	MB4204M
nIC7	07205300	NJM2901N
	07246300	MB4204M
nIC8	07205300	NJM2901N
	07246300	MB4204M
nIC9	07205300	NJM2901N
	07246300	MB4204M
nIC10	07246400	MSM4022RS

Parts No.	Stock No.	Description
•Diode		
nD1	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD2	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD3	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD4	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD5	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD6	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD7	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD8	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD9	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD10	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD11	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD12	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD13	03117600	1S2473D
	46086000	1S1588
	46092700	US1035

Parts No.	Stock No.	Description
nD14	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD15	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
nD16	03117600	1S2473D
	46086000	1S1588
	46092700	1S1588
nPL2	07237800	FG645A6 Display Unit
nR35	46047100	100kΩ x 8 Block Resistor
nR53	46046000	12kΩ x 8 Block Resistor
nR60	46046000	12kΩ x 8 Block Resistor
nC33	07215500	5600pF 25V C.C.
nC34	07215500	5600pF 25V C.C.

4-2. F-3504 Micro Processor Circuit Board (Stock No. 00657201)

Component Side



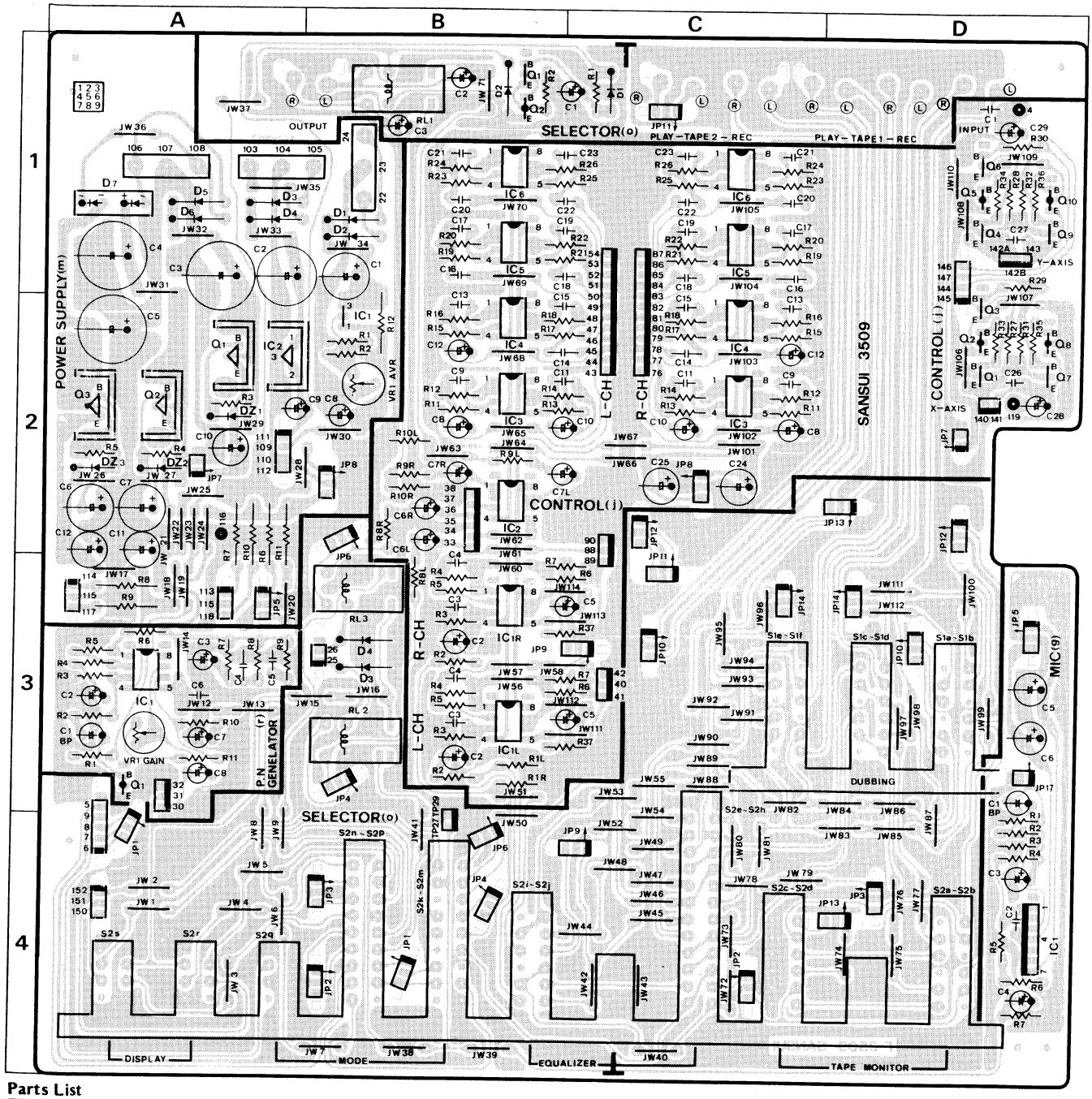
Parts List

Parts No.	Stock No.	Description
rXO1	46149200	Xtal, 3.58MHz
●Transistor		
rQ2	07194800	2SC1815-GR
	03068301	2SC2320-E
rQ3	07194800	2SC1815-GR
	03068301	2SC2320-E
rQ4	03064900	2SC1583-F
rQ5	03012700	2SA999-E
	07194700	2SA1015-Y
rQ6	03012700	2SA999-E
	07194700	2SA1015-Y
rQ7	03012700	2SA999-E
	07194700	2SA1015-Y
rQ8	03012701	2SA999-F
	07194700	2SA1015-Y
rQ9	03012700	2SA999-E
	07194700	2SA1015-Y
●IC		
rIC2	46148300	MB84051BM
rIC3	46148300	MB84051BM
rIC4	46148300	MB84051BM
rIC5	07205200	NJM2902N
rIC6	46148400	MB84052BM
rIC7	03607700	NJM4558D
rIC8	46148700	NJM2903D
	46150300	TA75393
rIC9	46148500	HD7407
rIC10	07265700	HD7406
rIC11	46145500	MB8841-506M
rIC12	46148500	HD7407
●Diode		
rD1	03117600	1S2473D
	46086000	1S1588
rD2	03117600	1S2473D
	46086000	1S1588
rD3	03117600	1S2473D
	46086000	1S1588

Parts No.	Stock No.	Description
rD4	03117600	1S2473D
	46086000	1S1588
rD5	03117600	1S2473D
	46086000	1S1588
●Zener Diode		
rDZ1	03179000	RD13E-B
rDZ2	03179000	RD13E-B
rR45	46152600	270Ω 1/8W
rR65	00202600	150kΩ 1/4W M.R.
rR66	00211400	75kΩ 1/4W M.R.
rR67	00211400	75kΩ 1/4W M.R.
rR68	00211400	75kΩ 1/4W M.R.
rR69	00202600	150kΩ 1/4W M.R.
rR70	00202600	150kΩ 1/4W M.R.
rR71	00202600	150kΩ 1/4W M.R.
rR72	00202600	150kΩ 1/4W M.R.
rR73	00202600	150kΩ 1/4W M.R.
rVR3	10341900	470Ω B Log Amp. Adjust Volume, L level
rVR4	10342100	1kΩ B Comparator Adjust Volume
rVR5	10342500	47kΩ B Log Amp. Adjust Volume H level
rS1	46151800	Comparator Test Switch

4-3. F-3509 Power Supply & Resonance Circuit Board (Stock No. 00657701)

Component Side



Parts List

Parts No.	Stock No.	Description
•IC		
gIC1	07197400	M5214L
gC1	08451700	1.0μF 50V E.B.
•Transistor		
jQ1	46134200	2SD1111
jQ2	07206800	2SA952-M
jQ3	07194800	2SC1815-Y
jQ4	46134200	2SD1111
jQ5	07206800	2SA952-M
jQ6	07194800	2SC1815-Y
jQ7	46134200	2SD1111
jQ8	07206800	2SA952-M
jQ9	46134200	2SD1111
jQ10	07206800	2SA952-M

Parts No.	Stock No.	Description
•IC		
jIC1	03613800	NJM4559D-D
jIC2	03607700	NJM4558D
jIC3	03607700	NJM4558D
	07265800	MB3607M
jIC4	03607700	NJM4558D
	07265800	MB3607M
jIC5	03607700	NJM4558D
	07265800	MB3607M
jIC6	03607700	NJM4558D
	07265800	MB3607M
jC26	07216600	47000pF 25V C.C.
jC27	07216600	47000pF 25V C.C.

to be continued ▶

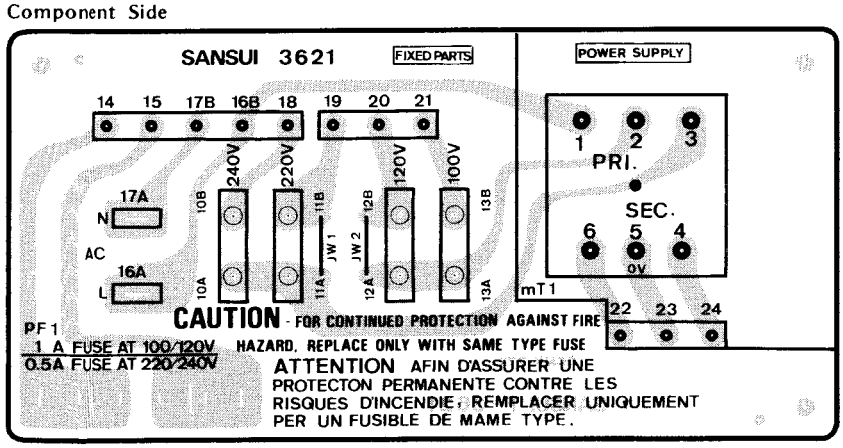
Parts List <F-3509>

Parts No.	Stock No.	Description
•Transistor		
mQ1	07287100	2SD1147-C
mQ2	07287100	2SD1147-C
mQ3	07287000	2SB862-C
•IC		
mIC1	46148600	78L05A
mIC2	07183500	UPC78M05H
•Diode		
mD1	03117700	10E-2
mD2	03117700	10E-2
mD3	03117700	10E-2
mD4	03117700	10E-2
mD5	03117700	10E-2
mD6	03117700	10E-2
mD7	03117000	RB-152
mD8~10	03117600	1S2473D
•Zener Diode		
mDZ1	46114600	05Z15-Z
mDZ2	46114600	05Z15-Z
mDZ3	46114600	05Z15-Z
mR12	00180700	180Ω 1W N.I.R.
mVR1	10341500	100Ω B Power Supply Voltage Adjust Volume
•Transistor		
oQ1	07194800	2SC1815-Y
	03068301	2SC2320-E
oQ2	07194700	2SA1015-Y
	03012700	2SA999-E
•Diode		
oD1	03117600	1S2473D
	46086000	1S1588
	46092700	US1035
oD2	03117700	10E-2
oD3	03117700	10E-2
oD4	03117700	10E-2
oS1	46150000	Dubbing Switch
oS2	46150100	DISPLAY/MODE/EQUALIZER/ TAPE MONITOR Switch
oRL1	11505100	Relay
oRL2	11505100	Relay
oRL3	11505100	Relay
•Transistor		
rQ1	03012701	2SA999-F
•IC		
rIC1	03607700	NJM4558D
rC1	08450900	4.7μF 16V E.B.
rVR1	10343300	100kΩ Pink Noise Gain Adjust Volume

•Note: The circuit board F-3621 is not supplied as the assembled. However the individual parts on the circuit board are provided by orders.

4-4. F-3621 Power Transformer Circuit Board

Component Side



Parts List

Parts No.	Stock No.	Description
mT1	15005201	Power Transformer
pF1	07188400	1A 250V AC Fuse <100/120V>
	07188200	0.5A 250V AC Fuse <220/240V>

• Abbreviations

C.R.	Carbon Resistor	E.L.	Low Leak Electrolytic Capacitor
S.R.	Solid Resistor	E.B.	Bi-Polar Electrolytic Capacitor
Ce.R.	Cement Resistor	E.BL.	Low Leak Bi-Polar Electrolytic Capacitor
M.R.	Metal Film Resistor	Ta.C.	Tantalum Capacitor
F.R.	Fusing Resistor	F.C.	Film Capacitor
N.I.R.	Non-Inflammable Resistor	M.P.	Metalized Paper Capacitor
C.C.	Ceramic Capacitor	P.C.	Polystyrene Capacitor
C.T.	Ceramic Capacitor, Temperature Compensation	G.C.	Gimmic Capacitor
E.C.	Electrolytic Capacitor		

5. ADJUSTMENTS

1-1. Regulated Power Supply Circuit Adjustment (See Top View on Page 12)

Note:
1. Before adjustment, run the unit for more than 5 minutes.
2. Room Temperature . . . . . 18°C ~ 28°C (65°F ~ 83°F)

MEASURE OUTPUT	EQUIPMENT	ADJUST	ADJUST FOR	REMARKS
Between TP23 for ⊕ & TP25 for ⊖ on F-3504	DC Volt Meter	mVR1 (F-3509)	DC 5V ±0.025V	If not adjustable for less than 5.025V, set mVR1 for minutes voltage.

1-2. Log Amp Adjustment

Note:
1. For this adjustment, an external REGURAED DC POWER SUPPLY is regulated.
2. Before adjustment, run the unit for more than 5 minutes.
3. Room temperature . . . . . 18°C ~ 28°C

SUBJECT	SETTING OF REGULATED DC POWER SUPPLY	MEASURE OUTPUT	ADJUST	ADJUST FOR
High Level Adjustment	Between TP1 for ⊕ & TP3 for ⊖ on F-3504 Output Level 8.58V	Between TP5 for ⊕ & TP7 for ⊖ on F-3504 DC Volt Meter	rVR5 F-3504	DC 9.6V
Low Level Adjustment	Between TP1 for ⊕ & TP3 for ⊖ on F-3504 Output Level 0.64V		rVR3 F-3504	DC 0.6V F-3504

1-3. Comparator Adjustment

Note:
1. Before adjustment, run the unit for more than 5 minutes.
2. Room Temperature . . . . . 18°C ~ 28°C (65°F ~ 83°F)
3. Set Slide Switch rS1 on F-3504 to TEST Position

SUBJECT	MEASURE OUTPUT	ADJUST	ADJUST FOR
Vn + Δv Comparator Adj.	Between TP9 for ⊕ & TP13 for ⊖ on F-3504 DC Volt Meter	rVR4 F-3504	DC 9V ±0.01V
Vn − Δv Comparator Adj.	Between TP11 for ⊕ & TP13 for ⊖ on F-3504 DC Volt Meter		Confirm DC 0.3V $^{+0.01V}_{-0.50V}$

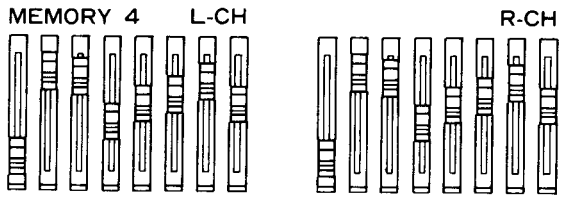
Note: After adjustment, reset slide switch rs1 to NORMAL position.

1-4. Pink Noise Level Adjustment

Note:
1. P.N LEVEL Volume . . . . . Max.
2. MODE Switch . . . . . ANALYZE
3. OUTPUT LEVEL Volume . . . . . Max.
4. DISPLAY Switch . . . . . ON

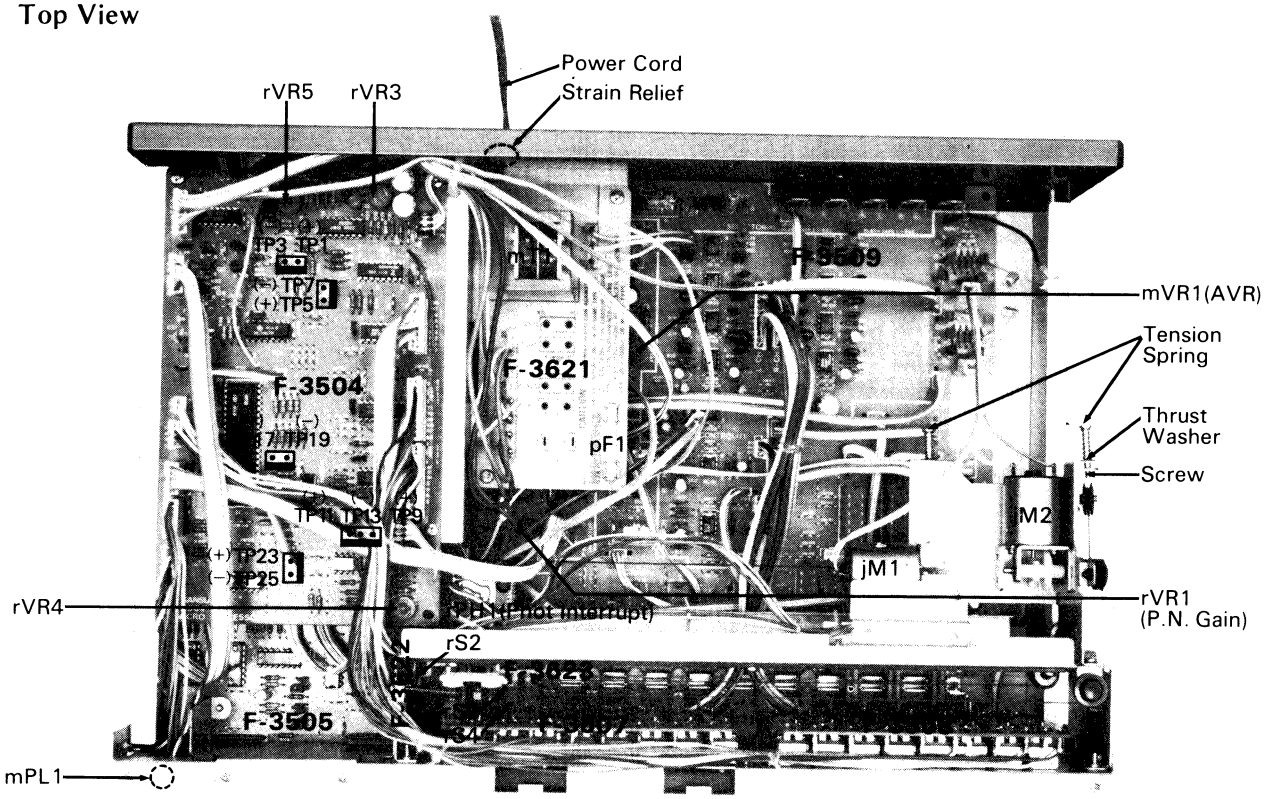
MEASURE OUTPUT	ADJUST	ADJUST FOR
OUTPUT Terminal VTVM	rVR4 F-3509	0.5V ±0.02V

- Note.
  After adjustment, confirm that proper operation is performed by depressing Sansui Sound Message Memory 4.

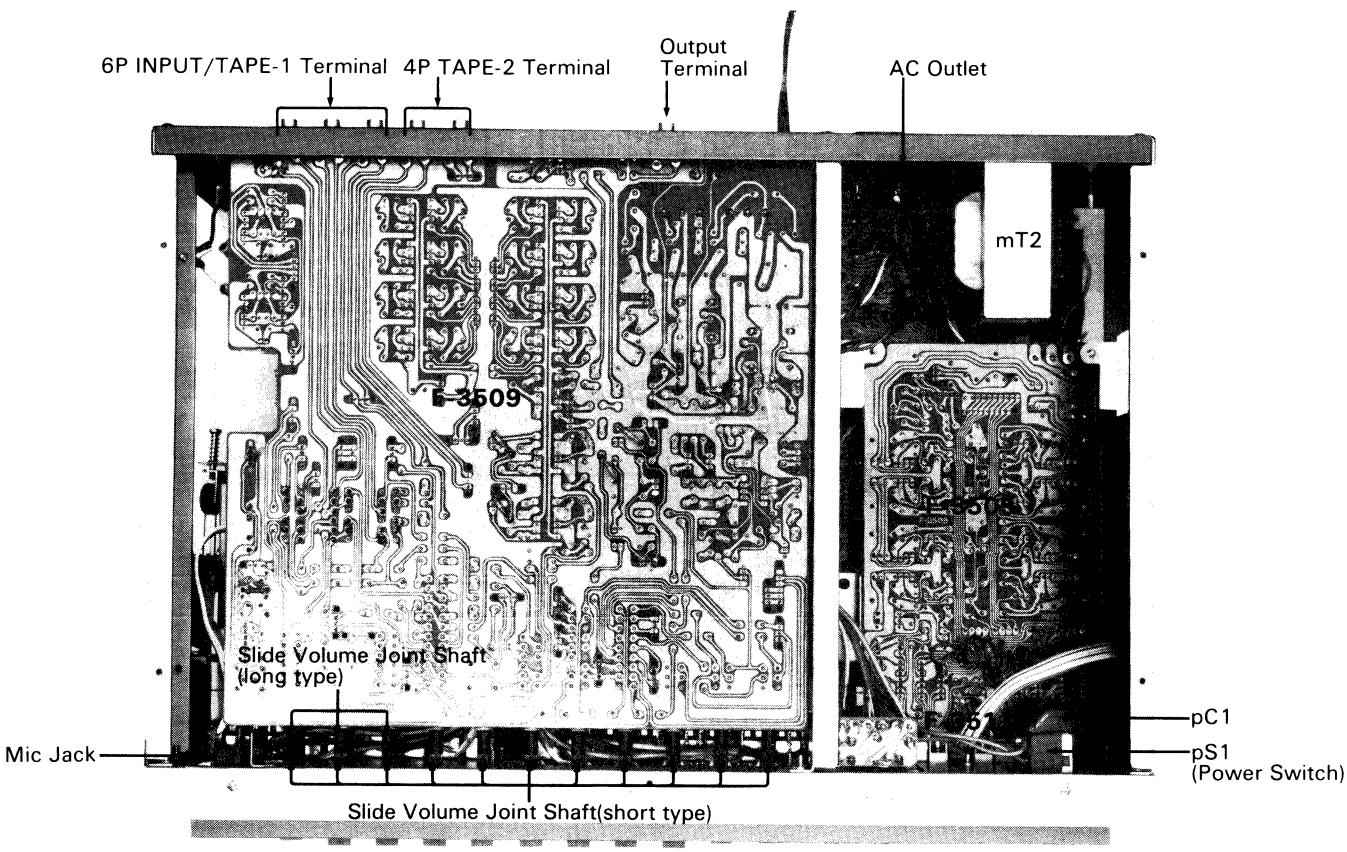


6. OTHER PARTS

6-1. Top View

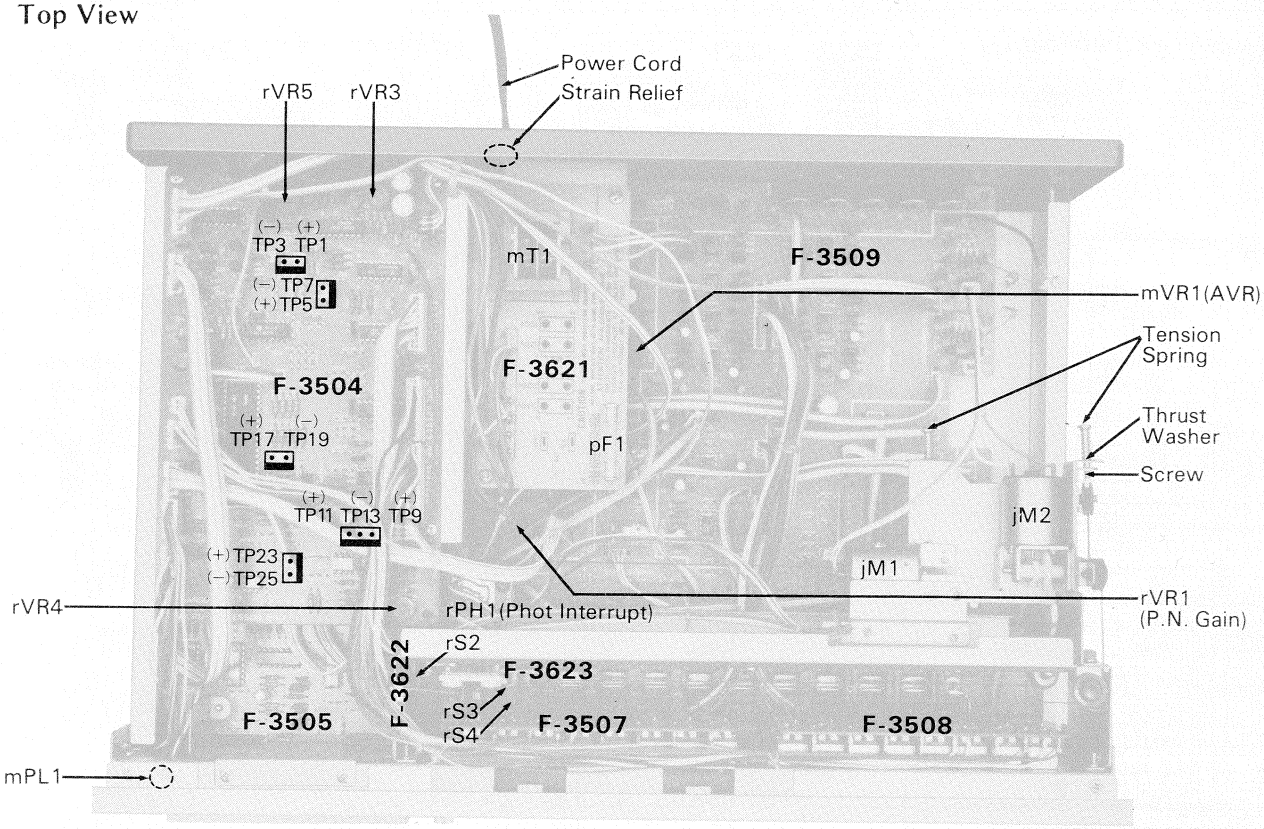


6-2. Bottom View

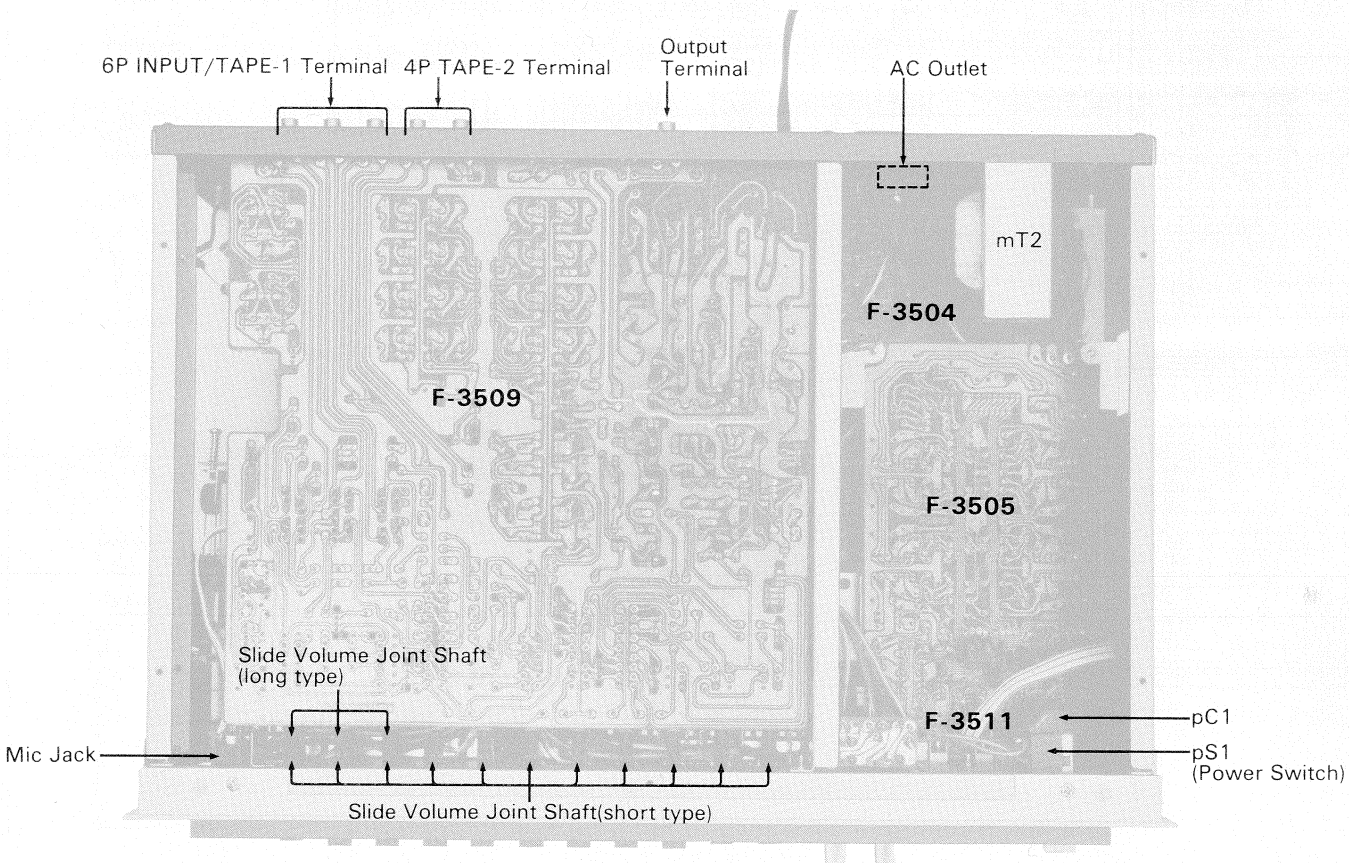


6. OTHER PARTS

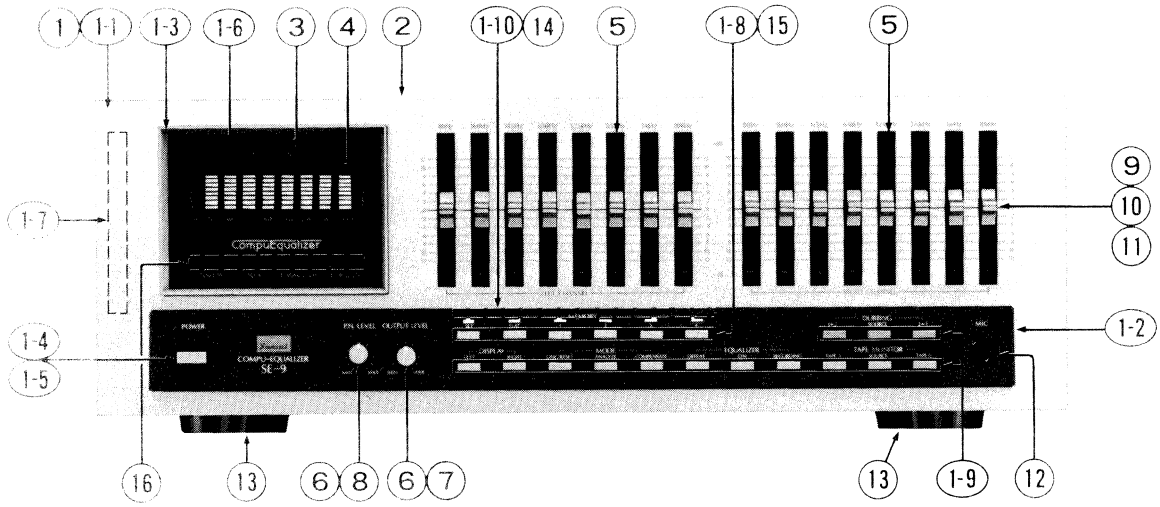
6-1. Top View



6-2. Bottom View



6-3. Front View



Parts List <Front View>

Parts No.	Stock No.	Description
1	07802300	Front Panel Ass'y (Silver Model)
1-1		Front Panel
1-2	07779500	Sub Panel
1-3	07779100	Hood
1-4	53194910	Power Switch Knob
1-5	53967720	Power Switch Knob Guide
1-6	07791100	Window Glass
1-7	07829700	Masking Sheet
1-8	07800500	Memory Switch Knob
1-9	07801100	Push Switch Knob, MODE/ EQUALIZER/TAPE MONITOR/ DUBBING/DISPLAY
1-10	07578000	Indicator
1	07802200	Front Panel Ass'y (Black Model)
1-1		Front Panel
1-2	07803200	Sub Panel
1-3	07803000	Hood
1-4	53194810	Power Switch Knob
1-5	53967720	Power Switch Knob Guide
1-6	07791100	Window Glass
1-7	07829700	Masking Sheet
1-8	07800600	Memory Switch Knob
1-9	07554100	Push Switch Knob, MODE/ EQUALIZER/TAPE MONITOR/ DUBBING
1-10	07578000	Indicator
2	07792100	Bonnet (Silver Model)
	07802600	Bonnet (Black Model)
3	07791200	Display Plate
4	07798500	Color Filter
5	07779200	Slide Volume Hood (Silver Model)
	07802700	Slide Volume Hood (Black Model)
6	07614300	Volume Knob, P.N. LEVEL/OUTPUT LEVEL (Silver Model)
	07680600	Volume Knob, P.N. LEVEL/OTUPUT LEVEL (Black Model)
7	46150700	50kΩ A x 2, output level volume
8	46150600	50kΩ A Pink Noise Level Volume
9	07777700	Slide Volume Knob (Silver Model)
	07767000	Slide Volume Knob (Black Model)
10	46150200	250kΩ/100kΩ B, fader volume, jVR2 ~ jVR9
11	07776400	Slide Volume Arm
12	07219700	MIC Jack
13	55073500	Leg
(F-3506)		
14	03193700	LED, nLD1 ~ 6, input key
15	46150500	Input Key Switch, oS3 ~ oS8
(F-3511)		
16	03193700	LED, nLD7 ~ 10, DISPLAY/MODE/ EQUALIZER/TAPE MONITOR/ DUBBING

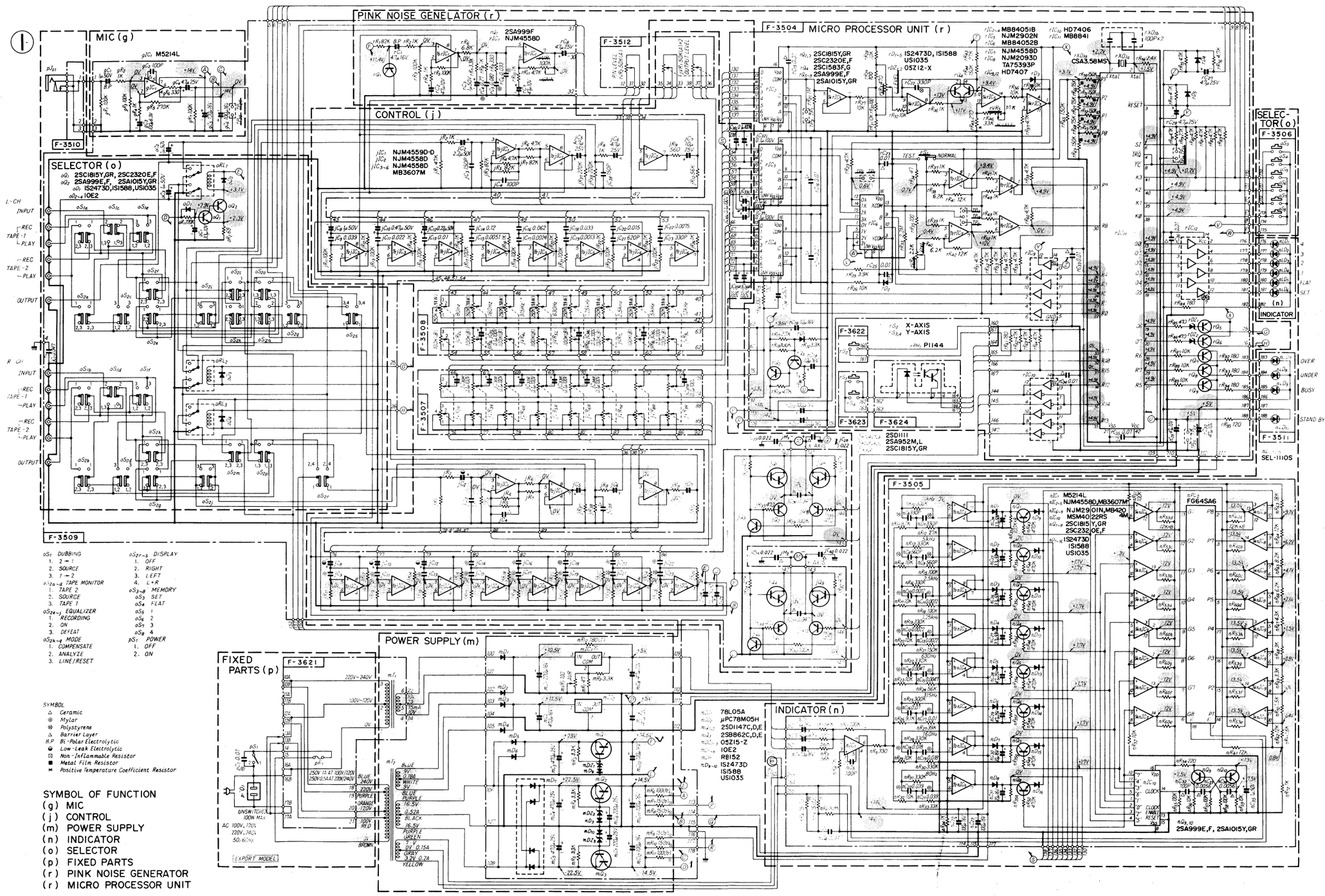
Parts List <Bottom View, Top View>

Parts No.	Stock No.	Description
rPH1	46148800	Photo Interrupt
pS1	46087300	Power Switch
mT2	15005301	Power Transformer
jM1, M2	07234100	Vertical Motor/Horizontal Motor
mPL1	04006600	Pilot Lamp, 8V 150mA
rS2	11907000	Start Sensor Switch
rS3	07209300	Y Axis Sensor Switch <Over Side>
rS4	07209300	Y Axis Sensor Switch <Under Side>
pC1	07269100	0.01μF 300V F.C.
	38004700	Power Cord
	39106000	Strain Relief
	07776800	Slide Volume Joint Shaft (long type)
	07776600	Slide Volume Joint Shaft (short type)
	07720400	Tension Spring
	51863500	Thrust Washer
	51660730	Screw, 22mm
	07189600	AC Outlet

witch)

- Design and specifications subject to change without notice for improvement.
- La présentation et les spécifications sont susceptibles d'éter modifiées sans préavis par suites d'améliorations éventuelles.
- Änderungen, die dem technischen Fortschritt dienen, bleiben vorbehalten.

7. SCHEMATIC DIAGRAM



oS_1 DUBBING
1. 2 → 1
2. SOURCE
3. 1 → 2

oS_{2R-4} TAPE MONITOR
1. TAPE 2
2. SOURCE
3. TAPE 1

oS_{2R-7} EQUALIZER
1. RECORDING
2. ON
3. DEFEAT

oS_{2R-9} MODE
1. COMPENSATE
2. ANALYZE
3. LINE/RESET

oS_{2R-5} DISPLAY
1. OFF
2. RIGHT
3. LEFT
4. L+R

oS_{3-8} MEMORY
oS_3 SET
oS_4 FLAT
oS_5 1
oS_6 2
oS_7 3
oS_8 4

pS_1 POWER
1. OFF
2. ON

SYMBOL
- Δ Ceramic
- Mylar
- Polystyrene
- Barrier Layer
- B.P Bi-Polar Electrolytic
- Low-Leak Electrolytic
- Non-Inflammable Resistor
- Metal Film Resistor
- Positive Temperature Coefficient Resistor

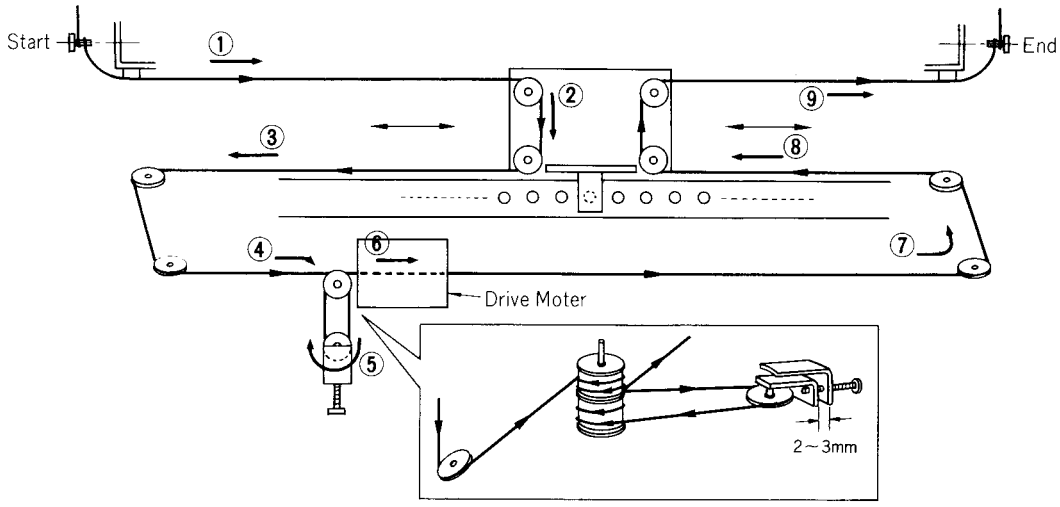
SYMBOL OF FUNCTION
(g) MIC
(j) CONTROL
(m) POWER SUPPLY
(n) INDICATOR
(o) SELECTOR
(p) FIXED PARTS
(r) PINK NOISE GENERATOR
(r) MICRO PROCESSOR UNIT

2SA952 2SC1583
2SA999 2SA1015 2SC1815 2SC2320 2SD1111
2SB862C 2SD1147
78L05A
MB3607M NJM4558D NJM4559D
μPC78M05H
M5214L
HD7406 HD7407
NJM2903D TA7539P
MSM4022RS
NJM2901N NJM2902N
MB4204M
MB84051B MB84052B
05Z15-2 10E-2 1S1588 VS1035
RB152
MB8841

8. REPLACEMENT OF FADER DRIVE CORD

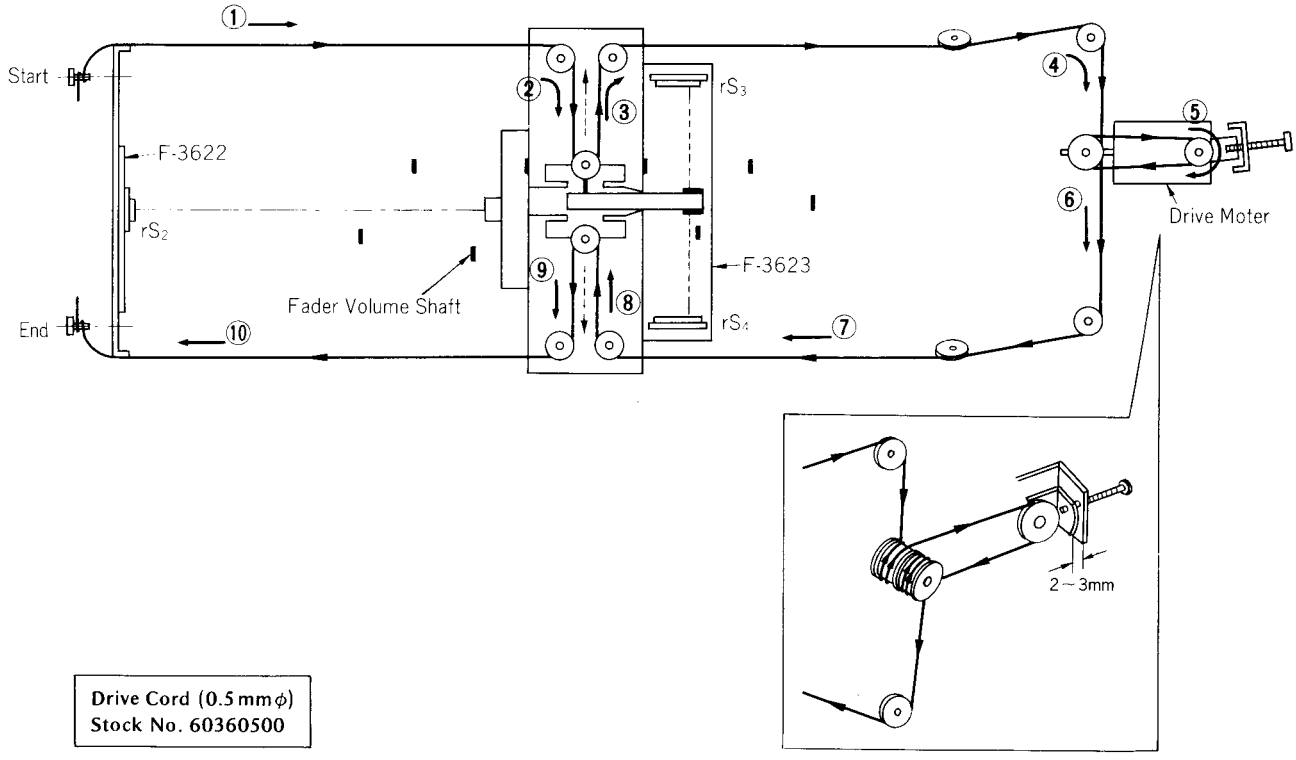
STEP 1. Threading of Horizontal Drive Cord

Thread the drive cord in numerical order from 1 to 9 as Fig. 8-1.



STEP 2. Threading of Vertical Drive Cord

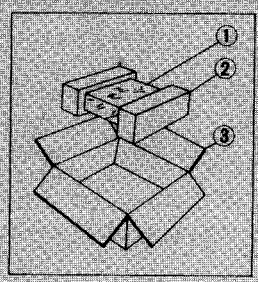
Thread the drive cord in numerical order from 1 to 10 as Fig. 8-2.



Drive Cord (0.5 mmϕ)
Stock No. 60360500

9. PACKING LIST

Parts No.	Stock No.	Description
1	91167810	Vinyo Cover
2	07801400	Carton Case (Silver Model)
	07801200	Carton Case (Black Model)
3	07815400	Styrofoam Packing

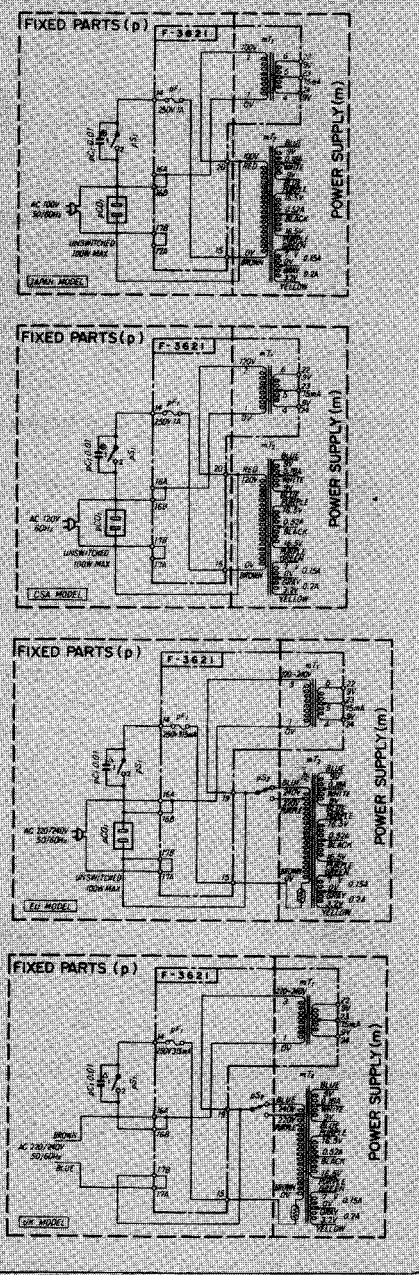


10. ACCESSORY LIST

Stock No.	Description
46124500	Microphone
38103300	Pin Plug Cord
07767900	Rack Mounting Adaptor (Black Model Only)
00462200	Binding Head Flanged Deltite Screw, 4 x 16 Black (Black Model Only)
46093000	Operating Instruction

SCHEMATIC DIAGRAM

<Power Supply Section>



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Printed in Japan (710830M)〈Stock No.36461600〉